FREE NOTES · NCERT + JEE LEVEL

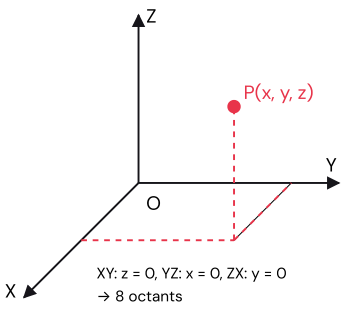
Introduction to 3D Geometry

Space me coordinate axes aur planes, octants aur signs, point ke coordinates, do points ke beech doori aur teen dimension me section formula.

01 Axes & coordinate planes
02 Point ke coordinates
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01 Axes & coordinate planes

O se teen aapas me perpendicular lines: X, Y aur Z axes (right-handed system). Har joda ek plane banata: **XY** (z = 0), **YZ** (x = 0), **ZX** (y = 0).



Space me point P(x, y, z)

02 Point ke coordinates

- P(x, y, z): x = YZ plane se doori, y = ZX plane se, z = XY plane se (sign ke saath).
- x-axis pe: (x, 0, 0); y-axis: (0, y, 0); z-axis: (0, 0, z).
- XY plane me: (x, y, 0); YZ plane: (0, y, z); ZX plane: (x, 0, z).
- (x, y, z) se XY plane pe perpendicular ka foot = (x, y, 0); x-axis pe = (x, 0, 0).

03 Octants & signs

Octant	I	II	III	IV	V	VI	VII	VIII
x	+	−	−	+	+	−	−	+
y	+	+	−	−	+	+	−	−
z	+	+	+	+	−	−	−	−

Trick: octants I–IV me z positive, V–VIII me negative; har group me (x, y) ke signs 2D quadrants jaise.

04 Distance formula

$$PQ = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2 + (z_2 - z_1)^2}$$

$OP = \sqrt{x^2 + y^2 + z^2}$

(x, y, z) ki x-axis se doori = √(y² + z²); XY plane se = |z|.

05 Section formula

Andar se $m : n \Rightarrow ((mx_2 + nx_1)/(m+n), (my_2 + ny_1)/(m+n), (mz_2 + nz_1)/(m+n))$

Bahar se $m : n \Rightarrow +$ ki jagah $-$: $((mx_2 - nx_1)/(m-n), \ldots)$

Midpoint $= ((x_1+x_2)/2, (y_1+y_2)/2, (z_1+z_2)/2)$

Triangle ka centroid $= ((x_1+x_2+x_3)/3, (y_1+y_2+y_3)/3, (z_1+z_2+z_3)/3)$

06 Kaam ke results

- **Collinear** points A, B, C: AB + BC = AC.
- Koi plane segment ko kis ratio me baant-ta: jaise YZ plane (x = 0) AB ko $-x_1 : x_2$ me (k : 1 lo aur x-coordinate = 0 rakho).
- Triangle ka type: teeno sides compare karo (barabar ⇒ equilateral; Pythagoras ⇒ right-angled).

07 Formula sheet

Doori	$\sqrt{(\Delta x^2 + \Delta y^2 + \Delta z^2)}$
Section (andar)	$(mx_2 + nx_1)/(m + n)$, ...
Midpoint	coordinates ka average
Centroid	jod/3

08 JEE Extra + Tricks

JEE LEVEL

- Section formula aur centroid seedhe 3D me (z jodo).
- Direction cosines $l^2 + m^2 + n^2 = 1$; lines ke beech $\cos\theta = l_1l_2 + m_1m_2 + n_1n_2$.
- (x, y, z) ki x-axis se doori = $\sqrt{(y^2 + z^2)}$; origin se $\sqrt{(x^2 + y^2 + z^2)}$.
- Coordinates ke antar ke ratios barabar ⇒ points collinear.

09 Solved examples

Q1. $(2, -1, 3)$ aur $(-2, 1, 3)$ ke beech doori.

$\sqrt{(16 + 4 + 0)} = \mathbf{2\sqrt{5}}$.

Q2. Dikhao $(-2, 3, 5)$, $(1, 2, 3)$, $(7, 0, -1)$ collinear hain.

$AB = \sqrt{14}$, $BC = 2\sqrt{14}$, $AC = 3\sqrt{14}$ ⇒ $AB + BC = AC$ ✓.

Q3. $(1, -2, 3)$ aur $(3, 4, -5)$ ko $2 : 3$ me andar se baantne wala point.

$((6 + 3)/5, (8 - 6)/5, (-10 + 9)/5) = \mathbf{(9/5, 2/5, -1/5)}$.

Q4. YZ plane $(-2, 4, 7)$ aur $(3, -5, 8)$ ko kis ratio me baant-ta?

$(3k - 2)/(k + 1) = 0 \Rightarrow k = 2/3 \Rightarrow \mathbf{2 : 3}$ andar se.

10 Common mistakes

- "x-axis se doori" ($\sqrt{(y^2 + z^2)}$) aur "YZ plane se doori" ($|x|$) me confusion.
- V–VIII ke octant signs galat.
- External section formula me + lagana.

11 Practice questions

1. (−3, 1, −2) kis octant me?
2. y-axis pe origin se 5 doori wala point.
3. (5, −1, 7) aur (x, 5, 1) ki doori 9 ho to x?
4. (1, 2, 3), (0, 4, 1), (−1, −1, −3) ka centroid.

ANSWERS

1) VI · 2) (0, ±5, 0) · 3) x = 2 ya 8 · 4) (0, 5/3, 1/3)

12 Quick revision: exam se 5 minute pehle

BASICS

- 3 axes, 3 planes, 8 octants.
- XY: z = 0.

DOORI

- $\sqrt{(\Delta x^2+\Delta y^2+\Delta z^2)}$.
- x-axis se $\sqrt{(y^2+z^2)}$.

SECTION

- 2D jaisa + z.
- Plane ratio: coordinate 0 rakho.

COLLINEAR

- AB + BC = AC.

Koi doubt? padhaiadda.netlify.app pe AI Doubt Solver se poocho, ya is chapter ka mock test do.